

ITS Field Operational Test Summary

Real-Time Vehicle Emissions Detection (R-TED)

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Introduction

The R-TED ITS Field Operational Test demonstrated a prototype, field-level emissions testing system in Denver, Colorado. The test analyzed the actual tailpipe emissions of individual vehicles and displayed the results to drivers. The test intended to raise the level of awareness of motorists about emissions and air pollution. The test also intended to promote voluntary repairs or tune ups by owners to minimize harmful tailpipe emissions.

The test took place between May 1996 and August 1997.

Project Description

The test installed a Remote Sensing Device (RSD) and a variable message sign (VMS) on a freeway off-ramp leading to a major Denver arterial roadway near the center of the city. Using an active infrared emissions sensor, the RSD analyzed the emissions of vehicles exiting the freeway to determine their level of carbon monoxide (CO). As the vehicle passed the detector, a camera took an image of the vehicle's license plate. As the vehicle passed the VMS, the equipment displayed a synopsis of the analysis. The combination of the technologies was called a Remote Sensing Information System (RSIS). Figure 1 presents the RSIS configuration.

The project's purpose was to test the accuracy of the RSIS and to evaluate motorists' perceptions and responses to the system. Test partners hoped to reduce fuel consumption, increase vehicle operating efficiency, educate the public about the benefits of a well-tuned car, and encourage voluntary emissions testing and repair of "high emitting" vehicles. The test included a public relations campaign to make drivers aware of the test, a telephone hotline to answer questions, and a brochure providing information. The brochure gave suggestions for reducing vehicle emissions.

Test personnel evaluated both the technical and the behavioral components of the project. They verified the function of the RSIS, the accuracy of the measurements, and the correctness of the information displayed on the VMS. Test personnel used the license plate image to identify vehicle drivers for inclusion in telephone surveys and case studies. Test personnel conducted a telephone survey of 474 motorists whose vehicles passed through the RSIS. Using the results of the survey and the case studies, test personnel evaluated the effectiveness of the information displayed on the VMS.

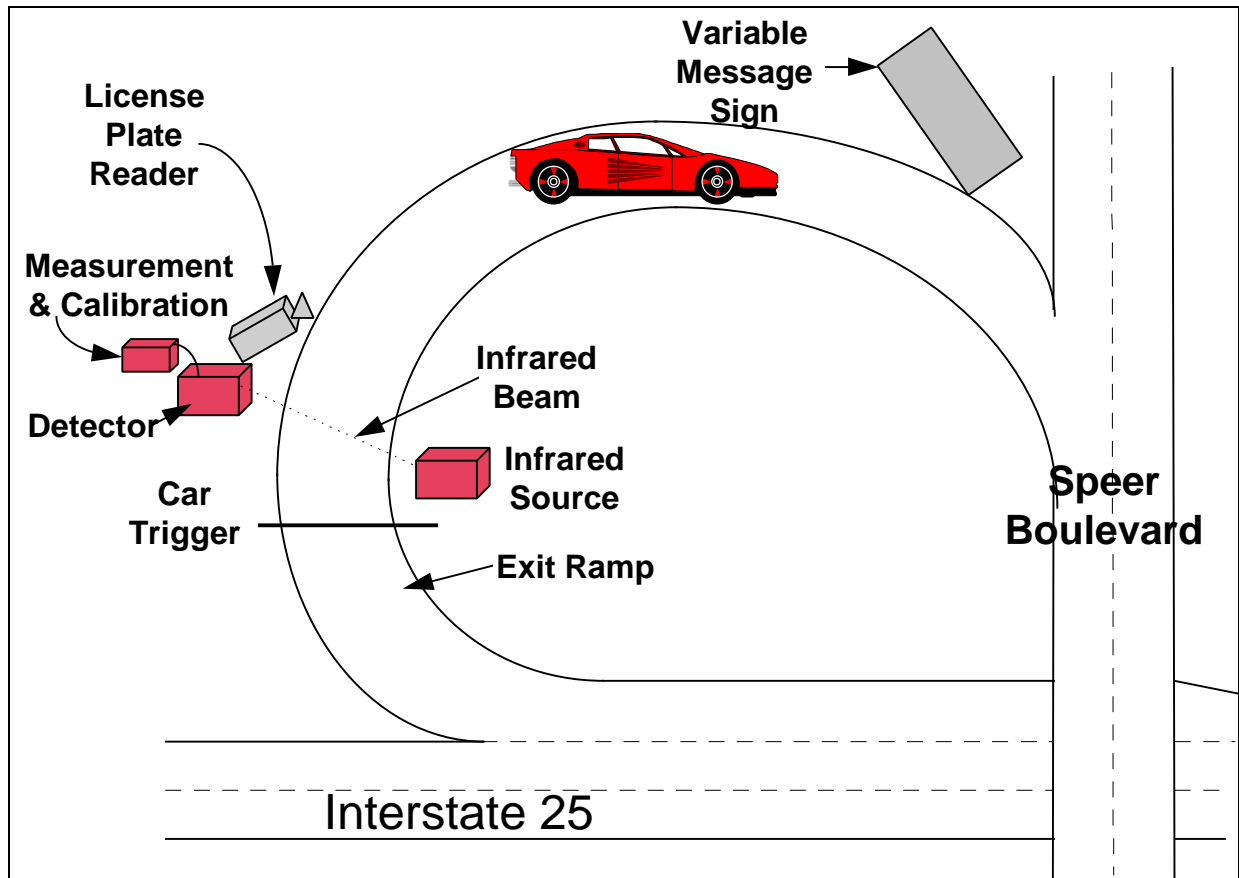


Figure 1: Real-Time Emission Detection System Physical Configuration

Evaluators made their conclusions based on:

- The RSIS technical performance. Did the system work? Were the emissions measured accurately? Was the correct information displayed?
- An assessment of motorist behavior. Did the sign's information influence the awareness, knowledge, and intentions of the motorists? Did motorists act in response to the sign's information? How much were motorists willing to pay to repair their vehicles to satisfy emissions requirements?

Results

System Technical Performance The test made these findings regarding technical performance:

- An on-board exhaust analyzer on a calibration vehicle confirmed that the RSIS accurately analyzed the emissions, except in the case of adverse weather conditions, accidents, equipment failures, or unforeseen events.
- The RSIS operated unattended over 90 percent of the time in the seven and a half months of the test. One-third of the down time occurred because contractors digging in the area severed an underground power cable. The sign subsystem accurately reported the vehicle's correct emission status.

- If one vehicle followed another too closely as they passed the detector, the RSIS invalidated the readings of both vehicles. Evaluators estimated that this caused incorrect readings for less than 0.7 percent of the vehicles, and no readings for about 1 percent of the vehicles.

Automobile User Behavior Assessment The test evaluator made the following basic findings in the behavioral assessment:

- Approximately two thirds of the telephone survey population thought the sign was informative. Respondents who received a “good” message recalled their readings better than those who received a “poor” or “fair” reading.
- Most respondents indicated that they understood the relationship between tailpipe emissions, vehicle maintenance, and fuel economy. Ninety-nine percent agreed with the statement “a well-maintained car can reduce air pollution,” and eighty-three percent claimed to maintain their cars at either three- or six-month intervals. Ninety-five percent agreed that a well-maintained car saves money.
- Of the survey population, 1.6 percent reported taking some remedial action. This figure indicates that the RSIS can motivate motorists to improve the condition of their cars. The sign delivered 3 million readings to over 230,000 unique vehicles. Simple extrapolation of the survey data supports a prediction that the sign encouraged drivers to make more than 4400 voluntary repairs during the test period.
- Respondents in the “poor” stratum were more than twice as likely to act because of seeing a message on the sign as those in the “fair” and “good” strata. This is a good indication that the population most in need of the information from the sign is the one most likely to respond.
- Seventy-six percent of the survey population had a favorable impression of the sign while only five percent had an unfavorable impression. Sixty-nine percent of those who received “poor” ratings had a favorable impression of the sign. Fifty-nine percent felt that voluntary programs like the RSIS would be likely to cause people to get their cars in better operating condition while only thirty-two percent thought it unlikely. Among the case study population, most of those with “good” readings said they would fix their cars if they received a “fair” or “poor” reading.

Legacy

Operation of the system concluded after the test was completed. Discussions are taking place to determine several possible follow on scenarios, including:

- Finding additional funding to resume operation of the RSIS at the current location
- Moving the RSIS (pending funds availability)
- Mounting the sign on a trailer to make the whole system portable so motorists outside the Denver metropolitan area could benefit.

Test Partners

Colorado Department of Public Health and the Environment

Colorado Department of Transportation

Conoco

Federal Highway Administration

Remote Sensing Technology

Skyline Products, Inc.

University of Denver

References

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Lacey, N., Bohren, L., and Hutton, R. B.; “Clearing the Air,” *ITS World*, Sept/Oct 1997, pg 42-44